# *Frequently Asked Questions About:*

# Cooperative Study of Streamflow Variations on Fall Chinook in the Hanford Reach Area of the Columbia River

***What is the name of the study?***
The study is titled "Effects of Hydropower Operations on Spawning Habitat, Rearing Habitat and Stranding/ Entrapment Mortality of Fall Chinook Salmon in the Hanford Reach of the Columbia River."

***What is the study's focus?***
Conducted from 2002-2005, the study evaluated the effects of upstream dam operations and resultant stream-flow magnitude and variability on adult fall Chinook salmon spawning habitat, juvenile salmon rearing habitat and juvenile salmon entrapment and stranding mortality in the Hanford Reach.

***Who was involved in it?***
The study was a cooperative effort by the U.S. Fish and Wildlife Service, the U.S. Geological Survey's Biological Resources Division, the Washington Department of Fish and Wildlife, the Alaska Department of Fish and Game, the Yakama Nation, the Columbia River Inter-Tribal Fish Commission, Nugent GIS and Environmental Services of Seattle, the Fish Passage Center, and Cexec Incorporated of Dulles, Virginia.

***Why was the study done?***
The study was undertaken to assess the impacts of river flow fluctuations on the productivity of Hanford Reach fall Chinook throughout the entire Hanford Reach and to analyze which flow regimes best benefit this fish population.

***Where is the Hanford Reach?***
The Hanford Reach is the area of the mid-Columbia River that extends 51 miles from Priest Rapids Dam downstream to the head of McNary Pool near Richland, Washington. It is the last significant non-tidal, un-impounded portion of the Columbia River still accessible to salmon for spawning and rearing.

***Why are Hanford Reach fall Chinook important?***
The Hanford Reach supports the largest and most productive population of wild salmon remaining in the Pacific Northwest. Hanford fall Chinook, commonly called upriver brights, are one of the few remaining Columbia River populations that have not warranted listing under the Endangered Species Act. This population is considered a "core population" of fall Chinook salmon that may be used to re-colonize habitat in nearby tributaries and mainstream areas. Hanford fall Chinook also are the primary stock supporting Columbia River Treaty Indian subsistence and commercial fisheries as well as non-Indian sport and commercial fisheries. This stock also makes significant contributions to ocean sport and commercial fisheries as far north as southeast Alaska.

***What were the goals of the study?***
This study's goals were to better define fall Chinook production potential and limitations and to help identify effective protection, restoration, and management alternatives for fall Chinook in the Reach. The study results can help guide the development of sustainable escapement goals and fisheries by the Pacific Salmon Commission, the Pacific Fisheries Management Council and the Columbia River Fish Management Plan. The improved stock productivity resulting from effective application of the tools could ultimately lead to significant conservation and fishery benefits. These benefits would also likely extend to resident fish and other members of the aquatic community in the Reach.

***What did the study find?***
The study found that under current conditions, juvenile fall Chinook mortality in the Reach has been severely underestimated. Current levels of flow fluctuations in the Reach have significant effects on spawning habitat for adult fish and stranding and/or entrapment of juvenile fish.

***What is stranding and entrapment?***
Stranding occurs when fish are trapped on or under exposed rocks, gravel and sand as water elevation drops. Fish are entrapped when river levels drop and isolated pools are created. River flows in the Reach can fluctuate as much as 6 vertical feet in an hour and 12 vertical feet in 4 hours.

***What is the result of stranding or entrapment?***
Death is usually the result of stranding (100% mortality) or entrapment (approximately 82% mortality). Mortality occurs primarily when fish are stranded on the substrate after entrapments drain, or when warming of water in the entrapments causes thermal mortality. Fish may also be lost to predators in small shallow entrapments.

***Do we know how many fish have died due to stranding or entrapment?***
We estimate that in 2003, roughly 1.6 million juvenile fall Chinook were entrapped and that 1.3 million of them died. This estimate may be low due to difficulties in counting the total number of potential entrapment locations, in completely detecting entrapped fish, and the inability to quantify predation of entrapped and stranded fish.

***What are the study's conclusions?***
For a complete discussion of the conclusions please see the full text of the study at: http://www.fws.gov/pacific/columbiariver
The study concluded that flow fluctuations due to dam operations cause significant mortality of juvenile fall Chinook that rear in the Hanford Reach and that these impacts appear to be significantly greater than previously estimated. Reductions in flow fluctuation magnitude and frequency would significantly reduce entrapment mortality of juvenile fish. In addition, the study found that more stable flows would serve to improve spawning habitat for adult fish. And finally, study results suggest that the dams may be capable of providing more stable flows by using their physical storage capabilities to regulate their outflows. Study results highlight the importance of developing operational and streamflow management plans that are more effective at minimizing juvenile mortality and stabilizing habitat conditions.

***The release of this study does not represent a policy or a final decision***
***By the U.S. Fish and Wildlife Service***